

1 In the claims:

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3
4 38 (Previously presented) A power combiner having:
5 a central axis about which is disposed a plurality k of
6 cylindrical feed waveguides, each said feed waveguide having
7 a radius, an input port and a launching port, all centered
8 on a feed waveguide axis, said launching port including a
9 cylindrical helix;

10 a plurality k of focusing reflectors, one for each said
11 feed waveguide, each said focusing reflector centered on
12 said feed waveguide axis;

13 a final waveguide coaxial to said central axis and
14 collecting power reflected by each said focusing reflector
15 with a proximal final waveguide reflector port.

16
17 39 (Currently amended) The power combiner of claim 38
18 where

19 $(1/\pi) \arccos \left(\frac{p}{X_{pq}} \right) \frac{(m/X_{mn})}{\pi}$ is an integer, when

20 said p m = azimuthal wave number

21 said q n = radial wave number

22 said X_{pq} X_{mn} = the eigenvalue of the mode.

23
24 40 (Previously presented) The power combiner of claim
25 38 where said feed waveguide launch port helical section is
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1 formed by sweeping a line of length $L_{\text{feedlaunch}} = \theta * L_{\text{launch}} / 2 * \pi$
2 at said radius from and parallel to said feed waveguide
3 axis, where θ is the angle in radians about said feed
4 waveguide axis and said L_{launch} is the length of the helical
5 cut.

6

7 41 (Previously presented) The power combiner of claim
8 38 where said final waveguide is a cylinder.

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10 42 (Previously presented) The power combiner of claim
11 38 where said feed waveguide axis is parallel to said
12 central axis.

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14 43 (Previously presented) The power combiner of claim
15 38 where each said feed waveguide radius is equal to each
16 other said feed waveguide radius.

17

18 44 (Previously presented) The power combiner of claim
19 38 where at least one said feed waveguide radius is
20 different from any other said feed waveguide radius.

21

22 45 (Currently amended) The power combiner of claim ~~38~~
23 40 where each said feed waveguide helical section angle $\theta = 0$
24 is uniformly offset with respect to a plane from said
25 central axis to said feed waveguide center axis.

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2 46 (Currently amended) The power combiner of claim 38
3 40 where each said feed waveguide helical section angle $\theta = 0$
4 is not uniformly offset with respect to a plane from said
5 central axis to said feed waveguide center axis.

6
7 47 (Previously presented) The power combiner of claim
8 38 where said feed waveguide helical launch port has a
9 helical cut depth

10
$$L_{\text{feedlaunch}} = 2\pi \{ k_{\text{par}} \sqrt{1 - (m/X_{mn})^2} \} / \{ k_{\text{perp}} \cos^{-1}(m/X_{mn}) \}$$

11 where

12 k_{par} is the parallel, or axial wave number

13 m is the azimuthal index of the mode in said feed
14 waveguide

15 n is the radial index of the mode in said feed
16 waveguide

17 X_{mn} is the eigenvalue of the mode

18 K_{perp} is the perpendicular wave number.

19
20 48 (Cancelled)

21
22 49 (Previously presented) The power combiner of claim
23 38 where said reflector is formed by a curve extruded along
24 said central axis, said reflector curve comprising a locus
25 of points.

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50 (Previously presented) The power combiner of claim 49 where said locus of points satisfies the following criteria for each given locus point:

where each said feed waveguide has a circular feed caustic and a feed caustic phase front, and said final waveguide has a circular final caustic and a final caustic phase front, for each point on said locus, a first line segment starting from said locus point, touching said feed caustic and ending on said feed caustic phase front, and a second line segment starting on said locus point, touching said final caustic and ending on said final caustic phase front:

- a) the path length of said first line segment added to said second line segment is a constant,
- b) at each said locus point, an intersection point is defined by the intersection of said locus point and a line which is tangent to said reflector curve at said locus point, and a perpendicular line which is perpendicular to said tangent line at said locus point, said perpendicular line bisecting the angle formed by said first line segment and said second line segment.

1 51 (Previously presented) The power combiner of claim
2 38 where each said k reflectors, has an angular extent
3 about said central axis ~~is~~ of 360/k degrees.

4
5 52 (Currently amended) The power combiner of claim 38
6 where each said ~~input waveguide~~ feed waveguide input port is
7 coupled to a source of asymmetric traveling wave power, ~~said~~
8 ~~input power traveling~~ which travels through each said feed
9 waveguide, ~~reflecting~~ reflects from said reflector and is
10 collected in said final waveguide.

11
12 53 (Previously presented) The power combiner of claim
13 38 where each said feed waveguide, each said reflector, and
14 said final waveguide are electrically conductive.

15
16 54 (Previously presented) The power combiner of claim
17 38 where each said feed waveguide, each said reflector, and
18 said final waveguide include an electrically conductive
19 surface.

20
21 55 (Currently amended) A power combiner comprising:
22 a plurality k of feed waveguide cylinders, each said
23 feed waveguide cylinder having a feed waveguide axis and a
24 radius, and also having a launch end which includes a
25 helical cut ramp;

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1 a cylindrical final waveguide having a central axis;
2 a plurality said k of reflectors interposed between
3 said feed waveguide launch end and said final waveguide,
4 each reflector for directing wave energy from said feed
5 waveguide cylinder to said final waveguide;

6 where k is n integer greater than 1.

7
8 56 (Currently amended) The power combiner of claim 55
9 where

10 $(1/\pi) \arccos \left(\frac{p}{X_{pq}} \right) \frac{(m/X_{mn})}{\pi}$ is an integer, when

11 said p m = azimuthal wave number

12 said q n = radial wave number

13 said X_{pq} X_{mn} = the eigenvalue of the mode.

14
15 57 (Previously presented) The power combiner of claim
16 55 where said feed waveguide launch port helical section is
17 formed by sweeping a line of length $L_{\text{feedlaunch}} = \theta * L_{\text{launch}} / 2 * \pi$
18 at said radius from and parallel to said feed waveguide
19 axis, where θ is the angle in radians about said feed
20 waveguide axis and said L_{launch} is the length of the helical
21 cut.

22
23 58 (Previously presented) The power combiner of claim
24 55 where said feed waveguide axis is parallel to said
25 central axis.

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2 59 (Previously presented) The power combiner of claim
3 55 where any said feed waveguide radius is equal to any
4 other said feed waveguide radius.

5
6 60 (Previously presented) The power combiner of claim
7 55 where at least one said feed waveguide radius is
8 different from any other said feed waveguide radius.

9
10 61 (Previously presented) The power combiner of claim
11 ~~55~~ 57 where each said feed waveguide helical section angle θ
12 $=0$ is uniformly offset with respect to a plane from said
13 central axis to said feed waveguide center axis.

14
15 62 (Previously presented) The power combiner of claim
16 ~~55~~ 57 where each said feed waveguide helical section angle θ
17 $=0$ is not uniformly offset with respect to a plane from said
18 central axis to said feed waveguide center axis.

19
20 63 (Previously presented) The power combiner of claim
21 55 where said feed waveguide helical launch port has a
22 helical cut depth

23 $L_{\text{feedlaunch}} = 2\pi \{ k_{\text{par}} \sqrt{1 - (m/X_{mn})^2} \} / \{ k_{\text{perp}} \cos^{-1}(m/X_{mn}) \}$

24 where

25 k_{par} is the parallel, or axial wave number
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1 m is the azimuthal index of the mode in said feed
2 waveguide

3 n is the radial index of the mode in said feed
4 waveguide

5 X_{mn} is the eigenvalue of the mode

6 K_{perp} is the perpendicular wave number.

7

8

9 64 (Previously presented) The power combiner of claim
10 55 where said reflector is formed by a curve extruded along
11 said central axis, said reflector curve comprising a locus
12 of points.

13

14 65 (Previously presented) The power combiner of claim
15 64 where said locus of points satisfies the following
16 criteria for each given locus point:

17 where each said feed waveguide has a circular feed
18 caustic and a feed caustic phase front, and said final
19 waveguide has a circular final caustic and a final caustic
20 phase front, for each point on said locus, a first line
21 segment starting from said locus point, touching said feed
22 caustic and ending on said feed caustic phase front, and a
23 second line segment starting on said locus point, touching
24 said final caustic and ending on said final caustic phase
25 front:

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2 a) the path length of said first line segment added to
3 said second line segment is a constant,

4 b) at each said locus point, an intersection point is
5 defined by the intersection of said locus point and a line
6 which is tangent to said reflector curve at said locus
7 point, and a perpendicular line which is perpendicular to
8 said tangent line at said locus point, said perpendicular
9 line bisecting the angle formed by said first line segment
10 and said second line segment.

11
12 66 (Previously presented) The power combiner of claim
13 55 where said plurality comprises k feed waveguides and k
14 reflectors, and the angular extent of each said reflector
15 about said central axis is $360/k$ degrees.

16
17 67 (Currently amended) The power combiner of claim 55
18 where each said ~~input~~ feed waveguide is coupled to a source
19 of asymmetric traveling wave power, said ~~input~~ wave power
20 traveling through each said feed waveguide, reflecting from
21 said reflector and ~~collected~~ collecting in said final
22 waveguide.

1 68 (Previously presented) The power combiner of claim
2 55 where each said feed waveguide, each said reflector, and
3 said final waveguide are electrically conductive.

4
5 69 (Previously presented) The power combiner of claim
6 55 where each said feed waveguide, each said reflector, and
7 said reflector waveguide include an electrically conductive
8 surface.

9
10 70 (Currently amended) A power combiner comprising:
11 k feed waveguides, each said feed waveguide formed from
12 a 4 sided polygon conductor comprising a rectangle having a
13 width and height adjoining a triangle having same said
14 height, said polygon then rolled into a cylinder with ~~an~~ a
15 feed waveguide axis substantially parallel to said rectangle
16 width thereby forming said feed waveguide, said feed
17 waveguide having a feed waveguide radius about said feed
18 waveguide axis and a feed waveguide launch end adjacent to
19 said triangle;

20 a cylindrical final waveguide having a central axis;
21 a plurality said k of reflectors positioned between
22 said k feed waveguides and said final waveguide input end;
23 where k is greater than 1.

1 71 (Currently amended) The power combiner of claim 70
2 where

3 $(1/\pi) \arccos \left(\frac{p/X_{pq}}{m/X_{mn}} \right)$ is an integer, when

4 said p m = azimuthal wave number

5 said q n = radial wave number

6 said X_{pq} X_{mn} = the eigenvalue of the mode.

7
8 72 (Currently amended) The power combiner of claim 70
9 where said feed waveguide launch port helical section is

10 formed by sweeping a line of length $L_{\text{feedlaunch}} = \theta * L_{\text{launch}} / 2 * \pi$

11 at said feed waveguide radius from and parallel to said feed

12 waveguide axis, where θ is the angle in radians about said

13 feed waveguide axis and said L_{launch} is the length of the

14 helical cut.

15
16 73 (Previously presented) The power combiner of claim
17 70 where said feed waveguide axis is parallel to said
18 central axis.

19
20 74 (Previously presented) The power combiner of claim
21 70 where each said feed waveguide radius is equal to each
22 other said feed waveguide radius.

1 75 (Currently amended) The power combiner of claim 70
2 where at least one said feed waveguide radius is different
3 from any other said feed waveguide radius.
4

5 76 (Currently amended) The power combiner of claim ~~70~~
6 72 where each said feed waveguide helical section angle $\theta = 0$
7 is uniformly offset with respect to a plane from said
8 central axis to said feed waveguide center axis.
9

10 77 (Previously presented) The power combiner of claim
11 ~~70~~ 72 where each said feed waveguide helical section angle θ
12 $= 0$ is not uniformly offset with respect to a plane from said
13 central axis to said feed waveguide center axis.
14

15 78 (Currently amended) The power combiner of claim 70
16 where said feed waveguide helical launch ~~port~~ end has a
17 helical cut depth

$$18 \quad L_{\text{feedlaunch}} = 2\pi \{ k_{\text{par}} \sqrt{1 - (m/X_{mn})^2} \} / \{ k_{\text{perp}} \cos^{-1}(m/X_{mn}) \}$$

19 where

20 k_{par} is the parallel, or axial wave number

21 m is the azimuthal index of the mode in said feed
22 waveguide

23 n is the radial index of the mode in said feed
24 waveguide

25 X_{mn} is the eigenvalue of the mode

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1 K_{perp} is the perpendicular wave number.

2
3 79 (Currently amended) The power combiner of claim 70
4 where said reflector is formed by a curve extruded along
5 said central axis, said reflector curve comprising a locus
6 of points.

7
8 80 (Currently amended) The power combiner of claim 79
9 where said locus of points satisfies the following criteria
10 for each given locus point:

11 where each said feed waveguide has a circular feed
12 caustic and a feed caustic phase front, and said final
13 waveguide has a circular final caustic and a final caustic
14 phase front, for each point on said locus, a first line
15 segment starting from said locus point, touching said feed
16 caustic and ending on said feed caustic phase front, and a
17 second line segment starting on said locus point, touching
18 said final caustic and ending on said final caustic phase
19 front:

20
21 a) the path length of said first line segment added to
22 said second line segment is a constant,

23 b) at each said locus point, an intersection point is
24 defined by the intersection of said locus point and a line
25 which is tangent to said reflector curve at said locus

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1 point, and a perpendicular line which is perpendicular to
2 said tangent line at said locus point, said perpendicular
3 line bisecting the angle formed by said first line segment
4 and said second line segment.

5
6 81 (Previously presented) The power combiner of claim
7 70 where said plurality comprises k feed waveguides and k
8 reflectors, and the angular extent of each said reflector
9 about said central axis is $360/k$ degrees.

10
11 82 (Currently amended) The power combiner of claim 70
12 where each said ~~input~~ feed waveguide is coupled to a source
13 of asymmetric traveling wave power, ~~said input power~~
14 traveling through each feed waveguide, reflecting from said
15 reflector and collected in said final waveguide.

16
17
18 83 (Previously presented) The power combiner of claim
19 70 where each said feed waveguide, each said reflector, and
20 said final waveguide are electrically conductive.

21
22 84 (Currently amended) The power combiner of claim 70
23 where each said feed waveguide, each said reflector, and
24 said ~~reflector~~ final waveguide include an electrically
25 conductive surface.